REMARKS

In the Office Action dated October 7, 2002, the Examiner repeated the restriction requirement in this Application. Applicants have confirmed the election of Group I, claims 1-3 and have cancelled non-elected claims 4 and 5 without prejudice to filing a divisional application.

The Examiner has objected to the disclosure and drawings for informalities noted in the Office Action. Applicants have amended the specification to overcome this objection. Amendment of Paragraph 31 is believed to overcome the Examiner's objection to the drawings. No new matter is added by the amendments.

Claims 1-3 stand rejected under 35 USC Section 102(b) as anticipated by the Kim reference. As set forth above, claims 1-3 are amended to clearly distinguish over the Kim reference. Reconsideration and withdrawal of the rejection is requested in view of the above amendments and the remarks herein.

Applicants invention is a switchable power divider that uses reactive, i.e. lossless, matching stubs to provide a variable impedance match for the device according to the number of ports connected. Further the matching stubs are connected to the center conductor which is connected to the common port. The use of reactive matching stubs is advantageous in that a lower insertion loss can be provided, since there is no signal loss in the matching elements, and higher operating power can be achieved, since it is not necessary to deal with the heat generated in lossy resistive elements of the device.

The Kim patent discloses a modified "Wilkinson" Power divider also known as a "radial N-way combiner", wherein resistors are switched in to provide impedance matching of the device. The disadvantage of this device is that matching is not perfect, and insertion loss suffers from the use of resistive elements. The resistive elements are also a limitation with respect to power handling of the device.

As provided in the amended claims, the claimed device uses "reactive" matching elements which are "lossless"(as a practical matter). This is an inherent characteristic of the open circuit stubs disclosed. Further, as specified in the amended claims, the matching elements are arranged to connect to the center conductor connected to the common port. In the Kim arrangement, the matching resistors are connected to the individual switched ports.

Accordingly in view of the amendments to claims 1-3, the invention claimed is clearly distinguished over the Kim reference and this application is believed to be in condition for allowance, which action is respectfully urged.

Attached hereto is a **VERSION WITH MARKINGS TO SHOW CHANGES MADE.**

Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the Specification:

[0018] Figure 1 is a block diagram of a system which includes parallel power amplifiers 16 which receive coherent RF signals, generated by signal source 12 and divided in equal amplitude and phase relation by RF divider 14. The output signals from RF amplifiers **[16] 16A, 16B, 16C and 16D** are provided to combiner 18 and thereafter to antenna 20.

[0019] Those familiar with RF circuits will recognize that in a conventional system of the type shown in Figure 1, proper operation requires that all amplifiers 16**A-D** be operating to normal specification, with equal amplifier power and phase. In the event one of the amplifiers, such as amplifier 16C, should fail, the result will be a possible impedance mismatch at divider 14 and a power combining impedance mismatch at combiner 18. The resulting signal loss will exceed the 1/4 power loss normally associated with the failed amplifier, because of the impedance mismatch at the combiner. In the event that one of amplifiers 16 fails, or in the event that it is desired to disconnect one of the amplifiers 16, it is desirable to reconfigure power divider 14 and power combiner 18 to isolate the failed amplifier 16C from the other elements of the system.

[0020] Figure 2 is a schematic diagram of a conventional single-pole, N-throw (N=4) RF switch 22 having a signal input port 23 and switch selectable output portions 25A, 25B, 25C and 25D. In normal applications the switch reeds 24A, 24B, 24D and 24D are moved to connect only one of the output ports 25**A-D** to the input port 23. Because there is only a single connection at any time (except possibly during the switching process), assuming the load on the connected

output ports [25] **25A-D** is equal to the characteristic impedance of the transmission line and source 23, impedance match is achieved.

[0021] If more than one of the output ports 25**A-D** of switch 22 were connected, the input impedance at input port 23 will be a function of the impedance of all connected output ports. Accordingly, assuming that the output ports are 50 ohm loads, and two output ports are connected, the impedance at input port 23 will be 25 ohms. If all switch reeds 24**A-D** are moved to the connected position, and 50 ohm loads are provided at each output port, the impedance of input port 23 will be 12-1/2 ohms. Accordingly, activation of more than one switch reed 24**A-D** will normally cause a significant change in the input impedance, normally causing a mismatch and power loss by reflection.

[0023] The inner conductor portions shown in Figure 3 include a common input port 33, which is connected to a 50 ohm slab-line inner conductor 36 to be mounted within housing 42, as shown in Figures 4 and 5. Coaxial output ports 35A, 35B, 35C and 35D connect inner conductor 36 selectively to one or more of output ports 35**A-D**. According to the number of output ports connected, an input signal provided to input port 33 is provided as an output signal to one or more output ports 35. Reeds [34] **34A, 34B, 34C and 34D** are mechanically moved between open or "off" positions and closed or "on" positions by electromagnets in a conventional manner as will be further explained.

[0024] Those skilled in the art will recognize that when a single output port 35**A-D** is connected to input port 33 by one of switching reeds 34**A-D**, the load presented to input port 33 is a match, i.e., 50 ohm, impedance load. As additional output ports 35 are connected by

switching of their respective switch reeds 34**A-D**, provisions must be made for impedance matching the input port 33 to the changed load condition.

[0025] To provide for impedance matching, switchable matching stub reeds 37, 38 and 39 are **respectively** located at selected distances Dl, D2 and D3 along slab transmission line 36 from the switching connection point. Each impedance matching reed 37, 38, and 39 has a respective impedance matching length L1, L2 and L3, which is selected to provide reactive impedance matching for the power divider when 2, 3 or 4 of output ports 35**A-D** are connected to transmission line 36 by their respective switching reeds 34.

[0031] Reference is made to **the perspective view of Figure 6 and** the cross-sectional view of Figure 7, which illustrate**[s]** a typical configuration for operation of reeds 34 of the preferred embodiments of Figures 3 through 5. As shown **[**the perspective assembly view of**]** in Figure 6 **and Figure 7**, RF housing 42 is provided with a cover plate 46 to provide an RF assembly 48. A solenoid mounting plate 50 is secured to cover plate 46 and provided with solenoids 52 **having armatures 68, which act on pin 70 carrying reeds 34 which engage terminal 35 and center conductor 36** for activating the switch**.** **[**and**]** **The** impedance matching reeds **are similarly driven by solenoids.** A circuit board 60 is conveniently mounted above solenoids 52, and includes integrated circuits 66 for providing driving currents in accordance with supplied logic signals representing the desired state of the power divider, provided to terminal 62, and using DC power supplied to terminals 64.

[0033] Those skilled in the art will recognize that the switchable power divider of the present invention can be advantageously used in connection with a multiple solid state amplifier

device as shown in Figure 8. In connection with such amplifiers it is possible to provide a variable power output signal by selecting less than all of the four power amplifiers [16] **16A, 16B, 16C and 16D** for producing a combined output signal. In this case control logic 76 can control which of amplifiers [16] **16A, 16B, 16C and 16D** are to be activated and, accordingly, set the condition of divider 32 and combiner 32' using driver circuits 60. By control of the switching reeds 34 and the impedance matching reeds 37, 38 and 39, as shown in Figure 3, the number of output signals from the divider 14 or input signals to combiner 18 can be varied, while maintaining impedance match.

[0034] As an additional feature, it is possible to provide a power amplifier system which will have a "fail soft" characteristic. Monitor couplers [72] **72A, 72B, 72C and 72D** are provided at the output of each individual amplifier 16**A-D**, and the monitor signal is provided to detectors 74. Control logic 76 responds to a failure of any of amplifiers 16 to discontinue operation of that amplifier, and reconfigure power divider 14 and power combiner 18 for operation with the remaining three amplifiers. Accordingly, the amplifiers continues to function with reduced power output.

In the Claims:

1. (Amended) An RF signal divider, comprising a single-pole, N-way RF switch, where N is an integer of 3 or more, said switch being operable to connect up to N individual RF ports to **a center conductor connected to** a common port, and a switched **reactive** impedance matching network having at least N-1 switch-selectable **lossless** matching elements **arranged to connect to said center conductor**, said impedance matching network being arranged to provide selected

impedance matching for said N-way RF switch according to the number of said N individual ports that are connected to said common port by said switch.

2. (Amended) An RF signal divider responsive to supplied control signals and operative to connect up to N individual RF ports to a common port, where N is an integer of 3 or more, in response to supplied control signals, said divider comprising:

a single pole, N-way RF switch for selectively connecting said N individual ports to **a center conductor connected to** said common port in response to switch drive signals;

a switchable **reactive** matching network having N-1 switch-selectable **lossless** matching elements operative to be connected to said **center conductor of said** RF switch in response to matching element drive signals; and

a driver circuit responsive to said control signals for providing said switch drive signals and for providing said matching element drive signals accordingly to the number of said N individual ports designated to be connected by said control signals.

3. (Amended) An RF signal divider comprising:

a plurality of N individual ports, where N is an integer of 3 or more, each having an inner conductor contact terminal extending into an RF switch cavity;

an RF common port;

a planar inner conductor in said switch cavity, connected to said RF common port at one end and having a switch contact at a second end;

a plurality of N switch reeds each moveable by an electro-magnet between a first position contacting said planar inner conductor and a second position spaced from said inner conductor; and

a switchable **reactive** impedance matching network, comprising N-1 **lossless** impedance matching reeds moveable by an electromagnet between a first position contacting said planar conductor and a second position spaced from said planar conductor.